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ORDNANCE PAMPHLET 1256

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AVIATION ORDNANCE

**BOMB RACK MARK 53 AND AUXILIARY EQUIPMENT
(FOR LIGHTER-THAN-AIR USE ONLY)**

*Sample for
610947-25*



NAVY DEPARTMENT
BUREAU OF ORDNANCE
WASHINGTON 25, D. C.

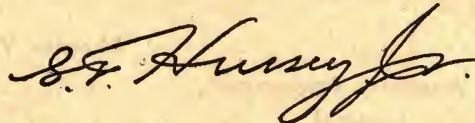
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2 October 1944

ORDNANCE PAMPHLET 1256

Bomb Rack Mark 53 and Auxiliary Equipment (For Lighter-Than-Air Use Only)

1. Ordnance Pamphlet 1256 describes and contains instructions for the operation, installation, and maintenance of the Bomb Rack Mark 53 and auxiliary equipment, which are for use in lighter-than-air ships only.
2. Naval personnel using the Bomb Rack Mark 53 and auxiliary equipment shall be governed by the instructions contained herein.
3. This pamphlet does not supersede any existing publication.
4. This publication is **RESTRICTED** and should be handled in accordance with Article 76, U. S. Navy Regulations, 1920.



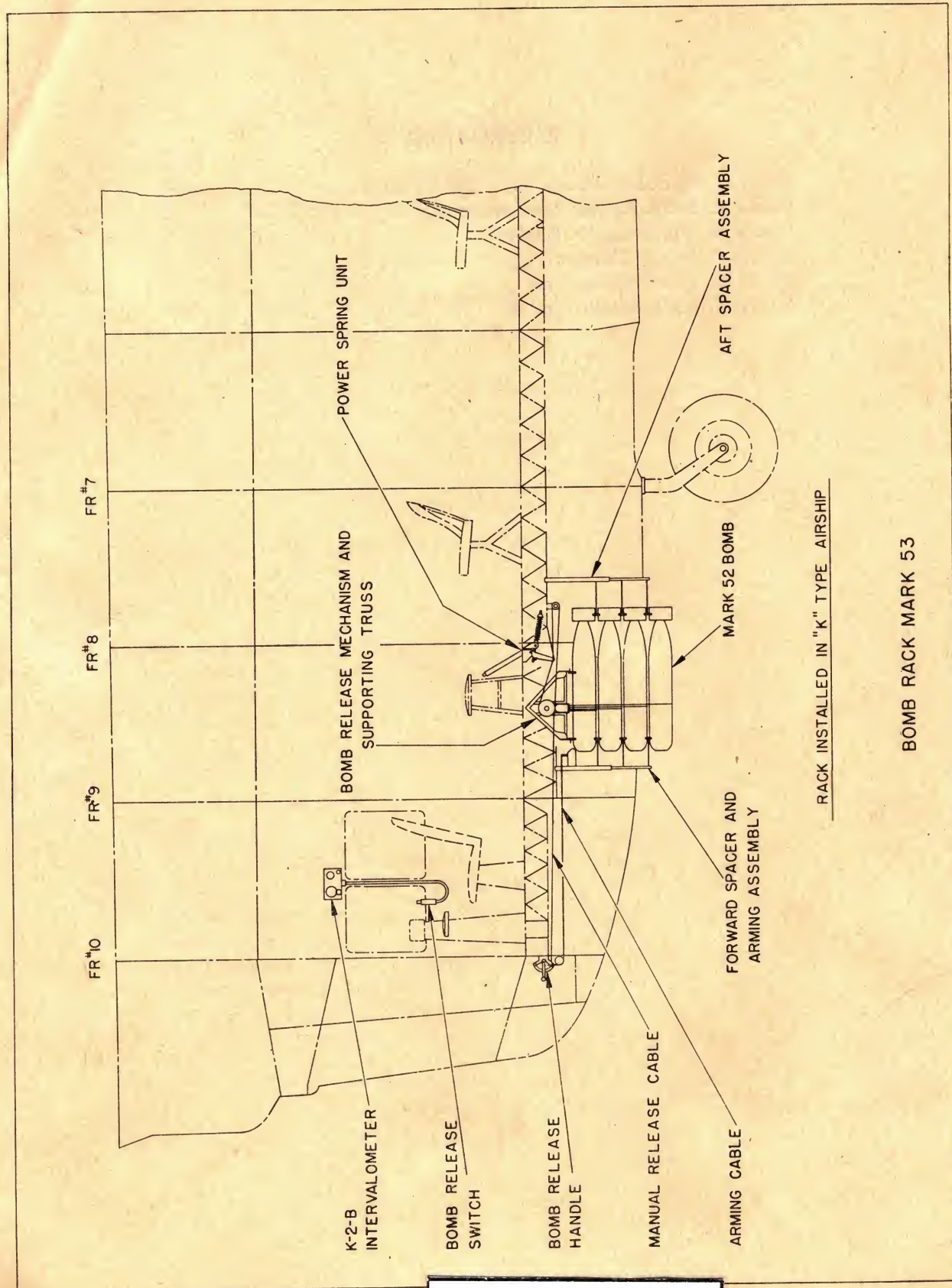
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Rear Admiral, U. S. Navy
Chief of the Bureau of Ordnance

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RACK INSTALLED IN "K" TYPE AIRSHIP

BOMB RACK MARK 53

AVIATION ORDNANCE

BOMB RACK, MARK 53 AND AUXILIARY EQUIPMENT (FOR LIGHTER-THAN-AIR USE ONLY)

Chapter I

GENERAL DESCRIPTION

General Data

Federal Stock No.-----	3-R-178
Operating Voltage-----	24
Weight (Approx)-----	100 lbs.
General Arrangement Dwg. No-----	253236
List of Drawings Sketch No-----	132134

Description (See Plate 1)

1. The Bomb Rack Mark 53 is designed for installation in the bomb-bay section of "K" type Airships. It operates in a nominal 24-volt direct current circuit.

2. This rack is designed to carry 8 or 16 bombs, Mark 52. The rack may carry 8 or 16 projector charges assemblies (7"2 Rocket Body Mark 5 (torpex loaded) with 2"25 Rocket Motor, Mark 3 (no cartridge, propellant or nozzle used)) for use as bombs if minor modification is made to the after spacer assembly. The bombs are secured in either 2 or 4 layers of four bombs each. These bombs may be released singly or in trains of any number up to 8 bombs each. Each bomb is individually supported by means of a cable slung under it. This method of suspension is used rather than the conventional bomb lug type suspension in order that the bomb may have a perfectly smooth surface thus improving the bomb's hydrodynamic characteristics. Hinged spacers to separate the bomb layers are provided, which swing out of the way after the last bomb in the layer below is released. When 16 bombs are carried, 6 spacers are used, 3 between the bomb noses and 3 between the bomb tails. When 8 bombs are carried only two spacers are needed.

3. Arming of the bombs is manual and is accomplished by means of a modified L-21A Bomb Release Handle, which is stamped "FOR L. T. A.".

All bombs are armed simultaneously by this single control. The Nose Fuze Mark 140 is used with the Bomb Mark 52 and the above projector charge assembly.

4. A safety locking unit is provided to prevent accidental operation of the rack.

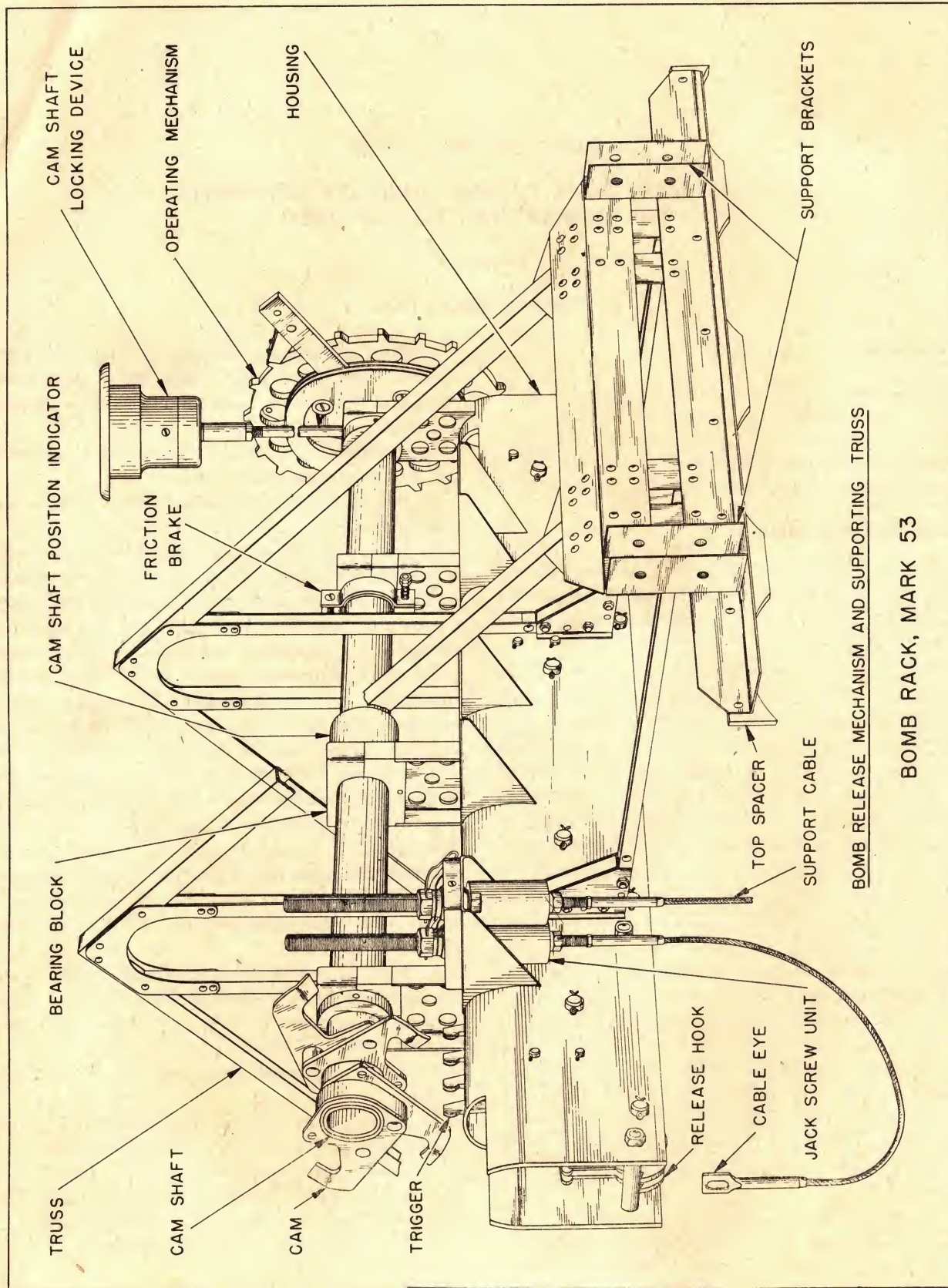
5. Bombs may be released either manually or electrically.

6. Electrical release is accomplished by means of a solenoid controlled by a bomb release switch and a K-2B Type Intervalometer. The operating mechanism which is controlled by the solenoid through an escapement, is rotated by energy supplied from the power spring unit. The power spring unit, when fully compressed, supplies energy to effect the electrically controlled release of 8 bombs. These may be released selectively or in trains of any number from two to eight bombs each. Although the bombs may be released in any sequence (for example: a train of three, then one selective, then a train of four), it is important to note that not more than eight bombs can be electrically released with a single setting of the power spring unit. The power spring unit may be compressed at any time.

7. Manual release is accomplished by means of the modified L-21A Bomb Release Handle. The power spring unit has no connection with the manual release mechanism and thus may be either relaxed or compressed when releasing bomb manually.

8. Bomb Racks, Mark 53 produced after 15 June 1944 (after Serial No. 20) incorporated a modified cam shaft position indicator (See Chapter IV Paragraph 3h and 5), stronger solenoid and power spring and various other minor modifications.

9. The following units are provided with each Bomb Rack, Mark 53:



BOMB RELEASE MECHANISM AND SUPPORTING TRUSS

BOMB RACK, MARK 53

(a) Bomb Release Mechanism and Supporting Truss:

- (1) Housing and Truss Assembly.
- (2) Operating Mechanism Assembly
- (3) Cam Shaft Locking Device.

(b) Power Spring Unit:

- (1) Power Spring Assembly.
- (2) Setting Handle.
- (3) Cover Plate.
- (c) Forward Spacer and Arming Assembly.
- (d) After Spacer Assembly.
- (e) Bomb Release Handle, "FOR L. T. A."

Chapter II

DESCRIPTION OF THE BOMB RACK, MARK 53

General Construction

1. The Mark 53 Bomb Rack consists of four main assemblies: The bomb release mechanism and supporting truss, the power spring unit, the forward spacer and arming assembly, and the after spacer assembly.

Bomb Release Mechanism and Supporting Truss (See Plate 2)

2. The housing of the release mechanism is a U-shaped steel member containing the release hooks and triggers. Welded to this housing are brackets from which the jack screw units that secure the support cables are hung. These jack screw units contain a compression spring through which loads on the bomb support cables are transmitted to the brackets. Each support cable has a cable eye secured to its free end which is placed in a release hook when the bomb is loaded. Each set of cable eyes, and release hooks is stamped serially from 1 to 16 in their order of loading into the rack.

3. Mounted on the release mechanism housing is a cam shaft supported on bearing blocks. There are 16 cams on this shaft, each set to trip a certain trigger in the proper order of bomb release. As each hook is released by the trigger, its corresponding support cable is freed thus releasing the bomb. One cam acts with each 20° rotation of the shaft. A friction brake is provided to prevent the cam shaft from rotating more than 20° for each electrical impulse.

4. Attached to the port side end of the cam shaft and housing is the operating mechanism (see Plate 3) which controls and actuates the rotation of the shaft. A driving cog with milled ratchet teeth is secured to the end of the cam shaft by taper pins. A manual drive plate and ratchet wheel, both of which have internal spring pawls, are mounted on

this driving cog. The spring pawls are arranged so that either the manual drive plate or the ratchet wheel may rotate the driving cog to operate the cam shaft—one remaining stationary while the other drives the shaft.

5. Electrical Operation. The rotational force on the ratchet wheel is applied by means of an arm and pawl attached to a pulley. This force is applied to the pulley by means of a cable from the power spring unit. (See Par. 8.) Rotation of the ratchet wheel is controlled by an escapement rocker which allows the ratchet wheel to advance one tooth each time voltage is applied to the solenoid. The solenoid actuates the escapement rocker through a small cam roller mechanism which permits the rocker to return and hold the next tooth even though the solenoid voltage should remain on longer than necessary. Voltage is applied to the solenoid by means of an electrical bomb release switch and an intervalometer from the power source in the airship. (See Plate 4.)

6. Manual Operation. The cam shaft may also be operated by the manual drive plate. This drive plate has two ears on it to which the manual drive cable and the spring return cable are attached. The driving cable leads to the bomb release handle in the airship. The spring return cable leads to a spring which is to be anchored to the ship. Stops are provided to prevent the plate from oscillating more than 20°.

7. The release mechanism housing is supported in the airship by a truss which has support brackets that attach to the regular bomb rack brackets in the airship.

Power Spring Unit (See Plates 1 & 5)

8. The power spring unit consists of a helical compression spring mounted on a guide rod with

a lever and latch arrangement for compressing it. The removable setting handle must be operated after 8 bombs are dropped because then the power spring becomes relaxed causing erratic operation of the rack and an eventual stoppage. A socket in the unit receives the setting handle which is used to apply the energy for compressing the spring. In order that the power spring unit may be actuated from within the ship, a slot is cut in the decking above the assembly. A cover plate is provided with a hinged cover giving access to this slot, which is only long enough to permit 8 bombs to drop.

Forward Spacer and Arming Assembly (See Plate 6)

9. The forward spacer and arming assembly consists of a tubular frame, secured at four points in the ship, with spacer arms pivoted on it and the arming mechanism secured to it. There are two arms supporting each spacer. Lateral tubes on these arms act as stops to prevent longitudinal movement of the bombs. The spacers have sectors of bomb radius out in them. When the bomb is secured, these prevent lateral and vertical movement of the bombs. The frame is constructed so that its lower

half, which supports the spacers for the third and fourth layers of bombs, may be removed. The rack will then be capable of carrying a load of only 8 bombs.

10. The arming unit is mounted on the tubular frame near the top. This arming unit consists of four arming wire retainers one for each vertical row of bombs. When 16 bombs are carried, there are four different lengths of arming wires used, one length for each bomb layer. Four arming wire loops are secured in each arming wire retainer which may be locked for retaining arming wires if the bombs are released in the armed condition or left unlocked if the bombs are to be jettisoned in the safe condition.

After Spacer Assembly (See Plate 6)

11. The after spacer assembly is similar to the forward spacer assembly. The same type of frame is used and the lower half is removable when only 8 bombs are to be carried. The spacer arms which are pivoted on this frame carry the spacers and lateral stop tubes.

Chapter III

OPERATION OF BOMB RACK, MARK 53

1. Open the cover plate for the power spring unit, and insert the setting handle. Pressing down on the thumb button on the top of the setting handle, swing the setting handle as far aft as possible and release pressure on the button. Then pull the setting handle forward until the unit is latched. The setting handle may then be removed and stowed away. The energy stored by setting the power spring unit is sufficient to actuate the rack in the electrical release of 8 bombs. If more than 8 bombs are carried, the spring must be recompressed after the first 8 bombs are released.

2. Turn the cam shaft locking screw to the position marked "Ready".

3. Set the arming lever of the bomb release handle to "armed" or "safe" as desired. All bombs in the rack are controlled by one lever. A "safe" train of bombs may be made subsequent to an "armed" train of bombs. However due to the design of the arming mechanism, an "armed" train

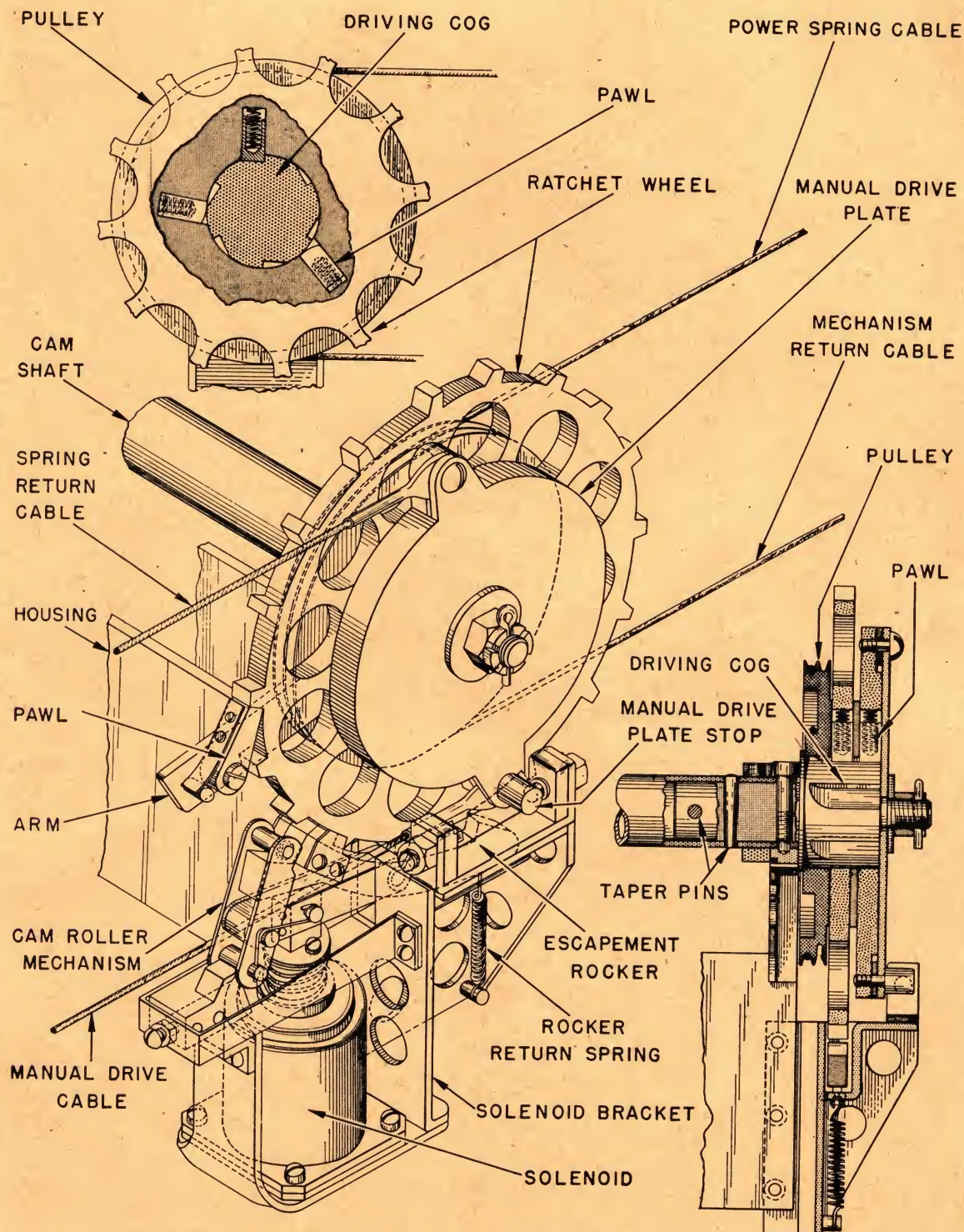
of bombs should not be made subsequent to a "safe" train of bombs. For example if eight (8) bombs should be dropped "safe," it is probable that the arming wires of the remaining eight (8) bombs will drop off the arming wire retainers at that time thus prohibiting an "armed" drop of the remaining eight (8) bombs.

4. Set the intervalometer for train or selective release as described in Chapter VII, Paragraph 3.

5. Start the release of the bombs by operating the bomb release switch.

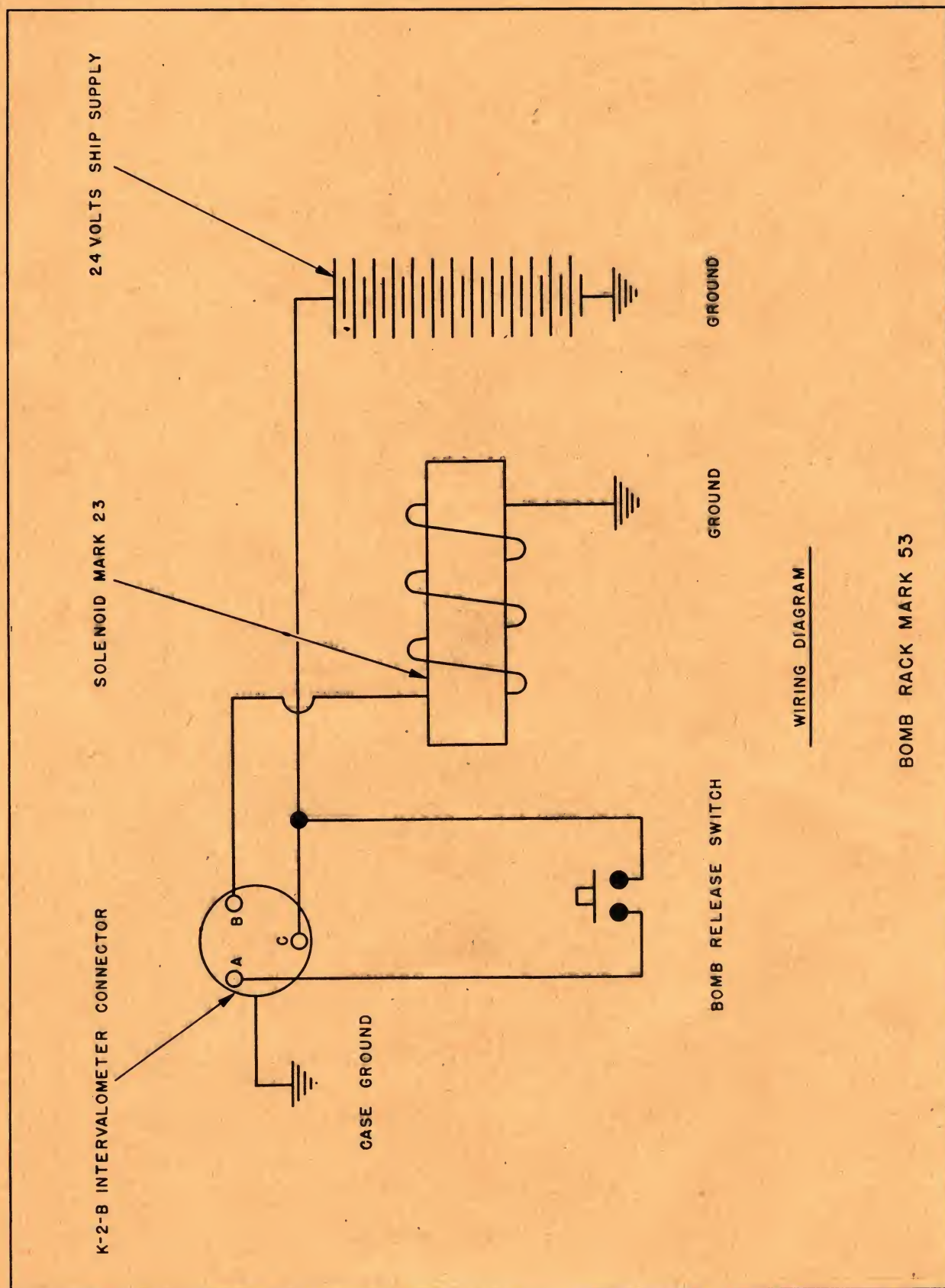
6. Should the electrical circuit become inoperative, bombs may be released manually by moving the release lever of the bomb release handle up and down, each upward movement of the handle releasing one bomb. If bombs are to be released manually, the power spring does not need to be set.

Note: Bombs cannot be dropped in "salvo" by this rack.



OPERATING MECHANISM

BOMB RACK MK 53



WIRING DIAGRAM

BOMB RACK MARK 53

Operating Data

7. The bomb rack should not be operated with a faster setting on the intervalometer than 60 knots at 11 foot spacing.

8. The system lag from the time an electrical impulse enters the intervalometer until a bomb is dropped is approximately .10 second.

Chapter IV

LOADING PROCEDURE

Testing

1. To test the arming unit, proceed as follows:

(a) Test the arming lever of the bomb release handle to make sure that the arming lever, connecting cables and the bomb rack arming mechanism are working freely.

(b) Set the arming lever at "Safe" and hang the arming wire loops on the arming wire retainers. A pull on each arming wire of two (2) pounds shall not open an arming wire retainer. A pull in the range of two (2) to eight (8) pounds shall open the arming wire retainer.

(c) Set the arming lever at "Arm" and hang the arming wire loops on the arming wire retainers. A pull of 25 pounds shall not open the arming wire retainer.

2. To test the operating mechanism, proceed as follows:

(a) Hang the support cable eyes on their correspondingly numbered release hooks and close the hooks. Test each cable and hook by applying a downward pull of 40 to 50 pounds to make sure none are defective.

(b) With the support cables in place, the hooks closed, and a small weight (10 pounds) hung on each cable loop, operate the rack electrically per Chapter III, Paragraphs 1-5. Each hook should open in order and the number of hooks opened should correspond to the number of impulses set on the intervalometer.

(c) Likewise, test the manual release of the rack per Chapter III, Paragraph 6.

Loading

3. To load the bombs, proceed as follows:

(a) Operate the release lever of the bomb release handle until the cam shaft position indicator reads "Load".

(b) Set both the cam shaft locking device and

the arming lever of the bomb release handle to the "Safe" position.

(c) Using a socket wrench lower all jack screws to give maximum cable slack. Hang the cable eyes on their correspondingly numbered release hooks making sure that each loop is free of the other loops. Rotate the hooks shut.

(d) Lift the first bomb into place by passing the bomb nose through the cable support loop, forward to its stop.

(e) Secure the bomb by raising the corresponding jack screw with a socket wrench. The jack screw has an adjustable stop which prevents excessive tightening of the cables. Before final tightening of the cable is attained, install the fuze and tighten. The bomb should now be rotated so that fuze arming wire loop is on top in such a position that the loop may be inserted in the arming wire retainers. Final tightening of the cable may now be accomplished. Lower rows of bombs should be similarly positioned so that the final arrangement is like that shown in the end view on plate 6. It may be found easier to install the fuzes in the bombs before the bombs are lifted into place in the rack. In such case, care must be taken not to drop the bombs while loading or otherwise subject them to severe bumps. The arming wires must be installed so that they are aft of the horizontal bar on the forward spacer assembly.

(f) Load the three remaining top layer bombs in the same manner.

(g) Swing the fore and aft spacer arms into position before loading the second layer of bombs and repeat this when loading the third and fourth layers.

(h) Operate the release lever of the bomb release handle twice to bring the cam shaft position indicator to "Ready 16" position. If 8 bombs only are carried, the shaft should be further advanced

to "Ready 8". Note: On later racks (see Chapter I, Paragraph 8) there are two intermediate positions "Ready 12" and "Ready 4" for use in carrying loads of 12 or 4 bombs respectively.

(i) Turn the cam shaft locking device to the "safe" position.

4. If only eight (8) bombs or less are to be carried by this rack, the following parts should be removed:

(a) Unbolt and remove the lower half of the after spacer assembly.

(b) Likewise, remove the lower half of the forward spacer assembly.

(c) Remove jack screw units and cables, numbers 9 to 16.

5. Although it is advised that full loads of either 8 or 16 be carried, it is possible to carry any number of bombs from one to 16. When partial loads are to be used, only those support cables with numbers

within the number of bombs to be loaded should be used (for example: carrying four (4) bombs use cables 1, 2, 3, and 4). When the cam shaft is to be advanced to a ready position, it will be necessary to subtract the number of bombs loaded from either 4, 8, 12, or 16 (whichever that number is less than) and advance the cam shaft from the "Ready 4", "Ready 8", "Ready 12", or "Ready 16" positions a number of positions corresponding to that difference (for example: carrying 6 bombs, advance the cam shaft 2 positions beyond "Ready 8", carrying 14 bombs, advance the cam shaft 2 positions beyond "Ready 16"). Note: The cam shaft locking device will only function when the shaft is at the "Ready 4", "Ready 8", "Ready 12", or "Ready 16" positions. Therefore, when carrying bomb loads other than 4, 8, 12, or 16, the cam shaft locking screw should be in the "Ready" position at all times.

Chapter V

INSTALLATION

(See Plate 6)

1. With the securing bolts ready, lift the bomb release mechanism and truss assembly into the four (4) mounting brackets in the airship bomb bay. Secure it with eight (8) bolts and nuts.

2. Install the forward spacer and arming assembly in accordance with the following procedure:

(a) Remove the clamps "A" on the upper cross member of this assembly.

(b) Position this unit and secure with the clamps "A" to the structural member of the airship.

(c) Secure the lower brace tube using the "U" bolts "B" provided.

(d) Rig a bungee cord from the lowest forward spacer, to an airship structural member directly forward of the forward spacer assembly.

3. Install the after spacer assembly, per the procedure in paragraph 2, except for paragraph 2 (d).

4. Install the Power Spring Unit in accordance with the following:

(a) Locate the unit and mark the slot and the holes for mounting bolts on the underside of the deck. The slot should be approximately 5'8 long by 1'5 wide, and positioned in line with the pulley of the operating mechanism.

(b) Cut the slot and drill the holes.

(c) Bolt the power spring unit in place with the cover plate on the top side of the deck.

5. Install the Cam Shaft Locking Device in accordance with the following:

(a) Locate the unit on the deck directly over the locking hole in the cam shaft.

(b) Cut the hole in the deck, drill the holes and bolt the unit in place. Check the operation of the unit.

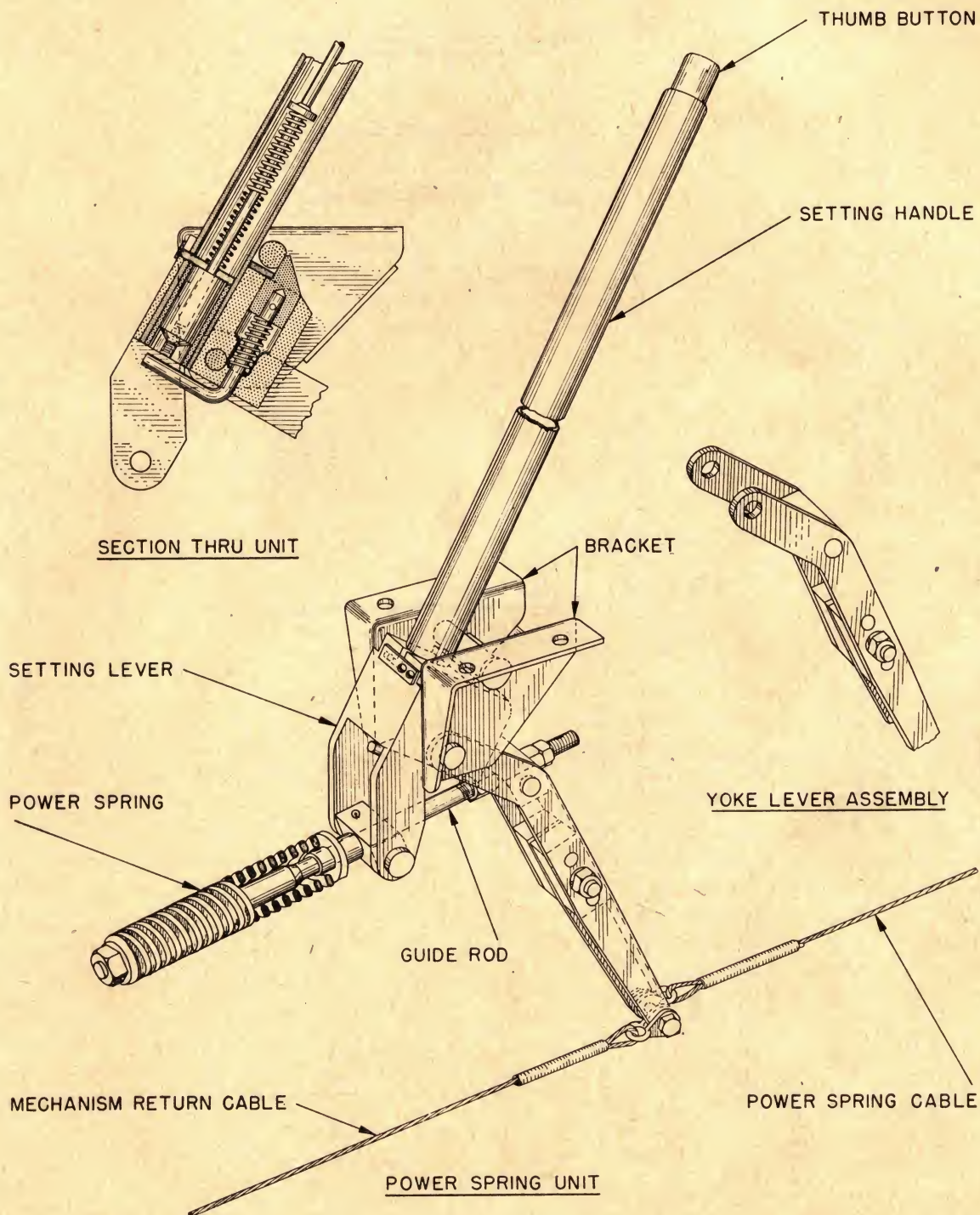
6. Install the electrical wiring, and cables and linkages as follows:

(a) A cable must be rigged from the lower ear of the manual drive plate to the release lever of the bomb release handle.

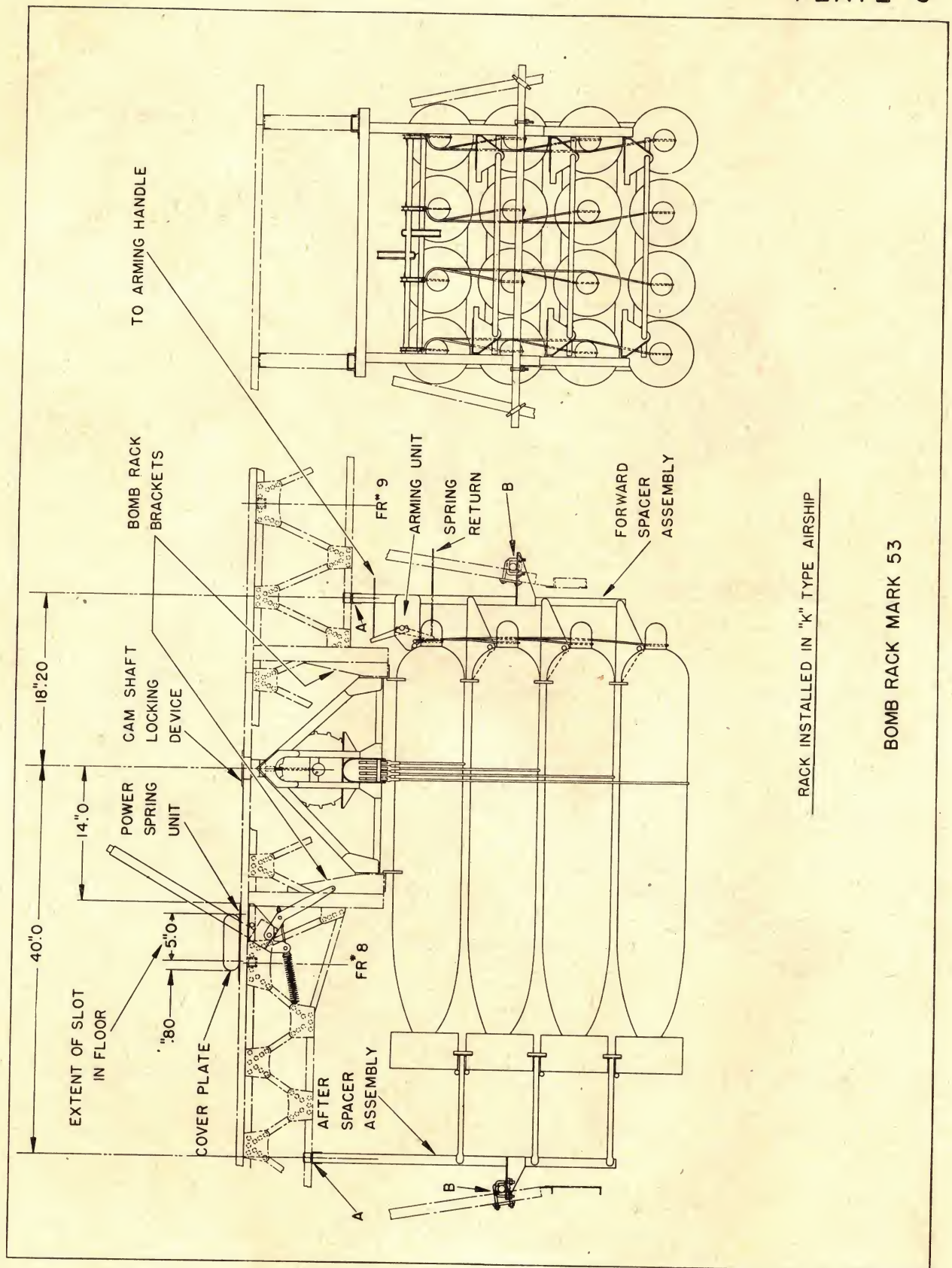
(b) The spring return which leads to the upper ear of the manual drive plate must be anchored to a structural member on the airship.

(c) The driving and return cables must be rigged between the power spring unit and the pulley. There must be a spring between the power spring unit and the pulley of the operating mechanism.

(d) The arming unit must be rigged with a cable from the arming lever of the Bomb Release Handle,



BOMB RACK, MARK 53



RACK INSTALLED IN "K" TYPE AIRSHIP

BOMB RACK MARK 53

and the spring return on the arming unit must be anchored to the ship.

(e) The wiring of the rack and auxiliary equipment should follow the diagram on Plate 4. The solenoid draws approximately 5.5 amps at the rated 24 volts. If two (2) or more racks are to be

installed in the airship, they should be connected in parallel from the "B" pin of the intervalometer. S. P. S. T. (Single Pole Single Throw) switches may be utilized to permit single or multiple operation of the racks.

Chapter VI

MAINTENANCE

1. To obtain consistently accurate bombing with this rack, it must be kept free of dust and dirt. The most critical parts are those in the operating mechanism. Therefore this mechanism especially should be cleaned regularly with Stoddard Solvent or kerosene to insure satisfactory operation of the rack at the faster intervalometer settings. When the operating mechanism is dissambled for cleaning it is advised that powdered graphite be used for lubrication, rather than oil, since lubricating oils

tend to attract dust and dirt. An alternate lubricant is a light weight, low temperature oil such as O. S. 1361.

2. Support cables should be examined frequently for frayed or broken wires and replaced if so worn.

3. The friction brake may need tightening, should it become worn sufficiently to allow more than one bomb to fall per actuation by the electrical release system. Care should be taken not to allow the lubricant to enter the brake.

Chapter VII

AUXILIARY EQUIPMENT

General

1. The following auxiliary equipment is necessary to operate the Bomb Rack, Mark 53. The Intervalometer, Type K-2B is supplied by the Bureau of Ordnance. The bomb release switch, wiring connectors and control cables may be obtained through the Bureau of Aeronautics if not available at the operating activities.

Intervalometer, Type K-2B

Federal Stock No----- 3-I-542
General Arrangement Dwg. No----- 328833

2. The Intervalometer, Type K-2B is a timing device designed to send out electrical impulses to the rack, in order to obtain a spacing between the bombs, as in a train release.

3. The intervalometer may be used for either selective or train release. This is controlled by the "Train-Sel" toggle switch which is set for "Sel" for selective release and "Train" for train release. When the intervalometer is set for selective release only one impulse is produced by the intervalometer each time the bomb release switch is closed. If it is

desired to drop a series of bombs in train, the "Train-Sel" toggle switch must be set to "Train", the right-hand counter set to the number of bombs to be dropped (for this rack a maximum of eight), and the left-hand dial must be set so that the ground speed of the airship in knots is set opposite the desired ground-spacing of the bombs. With the closing of the bomb release switch the intervalometer will send out a series of impulses corresponding to the setting of the two dials.

4. The pilot light will always glow if the intervalometer is set to "Sel", or if the intervalometer is set to "Train" and the counter is set to any position above zero. The pilot light can be dimmed by turning the barrel to the left. The intervalometer must be "on" (i. e. with the pilot light glowing) for at least one minute before dropping bombs; however, five minutes is desirable to obtain complete stabilization of the unit.

5. The intervalometer is designed to operate in an electrical system whose voltage may vary from 24 to 28.5 volts. There should be no parallel grounded circuits between the bomb release switch

and pin A of the Intervalometer. The wiring diagram (Plate 4) should be strictly followed. The current consumption for operation of the intervalometer is 1.7 amps. The Intervalometer will safely carry a maximum load of 15 amps.

6. No attempt should be made by operating personnel to clean, repair or adjust the intervalometer in any way. The Intervalometer, Type K-2B is a "technical item" and can only be repaired and properly adjusted by specially trained men at the Major Overhaul Points.

Bomb Release Switch

Naval Aircraft Factory Standard----- 1174-1

7. This bomb release switch is the standard firing key with two leads which is provided in typical airplane installations.

Wiring and Connectors

8. Shielded wiring and junction boxes as needed must be used to carry the current necessary to operate the rack and intervalometer. Either a straight AN 3106-14s-7S plug or a 90° angle AN 3108-14s-7S plug must be used to connect the wiring to

the intervalometer receptacle. An AN 3102-16s-4S receptacle is needed to mate with the plug on the end of the bomb release switch.

Control Cables

9. It is recommended that the operating activities use $\frac{1}{16}$ " stainless steel cables with swaged fittings, pulleys and turnbuckles as needed for the following necessary control cables:

(a) Cable from arming handle of the bomb release handle to the arming unit.

(b) Cable to connect the spring return from the arming unit to the airship structure.

(c) Cable from the release handle of the bomb release handle to the manual drive plate of the rack.

(d) Cable to connect the spring return from the manual drive plate to the airship structure.

(e) Cables between the power spring unit and the pulley of the rack's operating mechanism. A spring is provided as part of the rack and should be inserted into this cable line.

10. Bungee cord is needed for use on the lowest forward spacer. (See Chapter V, Paragraph 2 (d).)